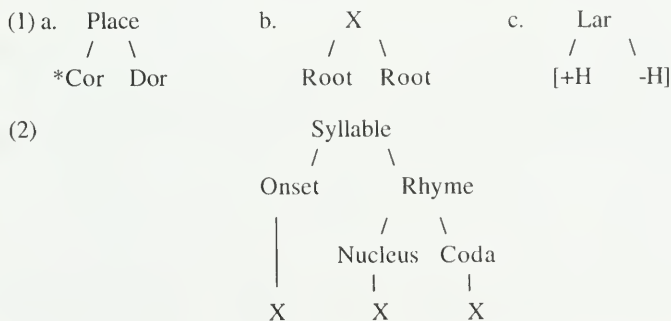


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## 1. Introduction

In this paper, I will argue that glides are a part of the onset. The hypothesis will be called the Single Onset Hypothesis (SOH). The difference between the SOH and the COH is that in the SOH a consonant and the following glide do not form a consonant cluster but are just one complex segment. By a complex segment I mean (1a), but not (1b) nor (1c).



This analysis leads to the more general claim that every constituent of a syllable is composed of just one segment; onset, nucleus or coda each has only one position as (2) shows. Following feature geometry, each segment is represented as a feature tree in this paper.

The rest of the paper is organized as follows. In section 2, the previous analyses of the Korean glides are reviewed. In section 3, the problems with these analyses are pointed out. In section 4, a new analysis is presented. In section 5, I illustrate the explanatory power of the present analysis. In the last section, I make some concluding remarks.

## 2. Previous studies

There has been much controversy over the analysis of glides in Korean. There are two views. The first view is that a glide can be assigned to one specific structure, under the nucleus or under the onset. The second view is that a glide can be anywhere in a syllable structure depending on the word in which a glide occurs.<sup>1</sup> This paper will take the first view. The second view will not be followed for three reasons. First, the first view presents a more restricted theory in the sense that it does not allow a rare structure which permits a rising diphthong. Second, for the Korean data we do not need all the other structures permitted by the second view other than a structure with a glide in the onset. Third, one of the structures admitted under the second view, the structure in which a glide is in the nucleus, is not acceptable for reasons which will become clear below.

### 2.1 Arguments for the Nucleus Hypothesis (NH)

First of all, let us look at the arguments for the NH, which are from Kim & Kim 1991 and Sohn 1987.

First, there is no co-occurrence restriction between an onset consonant and a following glide, but there are constraints on the possible coda consonant clusters and complex nuclei. According to Kim & Kim 1991, any consonant can come before glides in Korean, while only a small number of consonant clusters are allowed to occur in coda position. Also there is negative restriction on the possible complex nuclei such as \*ji or \*wu. This suggests that an onset consonant and a following glide are not within one node in a syllable.<sup>2</sup> The assumption here is that if the more restricted constraint holds between two units, then these are closer units.<sup>3</sup>

Second, Korean has a phenomenon called Consonant Cluster Reduction (CCR). This phenomenon is seen as a strong argument for the NH. The NH assumes that there is only one consonant both in the onset and in the coda. Therefore, the sequence of three consonants cannot be parsed in the syllable structure properly. One of the repair mechanisms put into operation is Consonant Cluster Reduction, which deletes the second consonant in a sequence of three. This is illustrated in (3).

- |  |                  |                      |
|--|------------------|----------------------|
| (3) kaps 'price: underlying form'            | kaps-i 'NOM'     | kap-man 'price only' |
| næks 'spirit: underlying form'               | næks-i 'NOM'     | næk-to 'soul also'   |
| antç- <sup>4</sup> 'to sit: underlying form' | antç-ætta 'PAST' | an-kəla 'IMP'        |

When a word ending underlyingly with a consonant cluster is followed by a word beginning with a consonant as in *kaps-man*, the resulting derived word comes to have three consonants. Then, one of the consonants, *s*, is deleted by the operation of Consonant Cluster Reduction. Thus, the resulting word is *kapman*. In contrast, when the word is followed by a vowel-initial suffix, *kaps-i*, both members of the consonant cluster survive, *kapsi*.

If a glide is in the onset, then -CCG- should be considered as a possible input to the Consonant Cluster Reduction, because they make a sequence of three consonants. However, CCR does not apply, as is seen in (4). That is, if *lpj* or *lkw* are considered a sequence of three consonants, one of three consonants must be deleted.

- (4) *ol-pjə* 'this year's crop'  
*sil-kwa* 'fruit'

The examples in (4) are interpreted to show that glides are not in the onset but in the nucleus.

Third, the phenomena of ideophones also provide an argument in support of the NH. The ideophone is formed by reduplication of the base as shown below.<sup>5</sup>

- (5) *k'opul-k'opul* 'winding'<sup>6</sup>  
*pintung-pintung* 'idling'

There are also partially reduplicated ideophones, as in (6), in which everything except the onset consonant is reduplicated.

- (6) *aki-tçaki* 'sweet'  
*osun-tosun* 'friendly'

When the words beginning with CGV- are the base for the partial reduplication, every segment except word-initial C is reduplicated, suggesting that the glide is not a part of the onset. That can be seen in (7). That is, if the glide is in the onset, then it should disappear in the partially reduplicated form. However, it survives.

- (7) *jam-njam* 'tasty'<sup>7</sup>  
*jək-ljək* 'vivid'  
*joŋ-rjoŋ* 'teasing'

The fourth piece of evidence for the Nucleus Hypothesis comes from a language game in which CV is inserted after the first CV of each syllable. The C in the inserted CV is always *p*. V copies the vowel from the base syllable. Then, if there is a coda consonant, it is attached to the end of the inserted CV. A simple rule for this change would be  $C_1V_1C_2 \rightarrow C_1V_1 - pV_1C_2$ . This is illustrated in (8).

- (8) *p<sup>h</sup>ato* → *p<sup>h</sup>a-pa to-po* 'waves'  
*kongtç<sup>h</sup>ek* → *ko-pong tç<sup>h</sup>ε-pek* 'notebook'

(9) shows what happens in words that contain glides. This language game shows where the pre-nucleus G belongs.

- (9) kwənsə → kwə-pwən se – pe 'power'  
 jaku → ja-pja ku – pu 'baseball'

According to Sohn, and as (8) illustrates, a glide is repeated in the inserted CV.<sup>8</sup> This means that a glide is not a part of the onset. Otherwise, along with the onset consonant, it should be replaced by *p* in the language game because the entire onset is replaced by *p* in the language game.

The fifth argument for the Nucleus Hypothesis is found in the pronunciation of the liquid *l*. The *l* is changed into [r] in pre-vocalic position (= syllable-initial onset position) but it remains [l] in coda position. (10) demonstrates this alternation.

- (10) kil 'street' kil – to [kilot] 'street also' kil-e [kire] 'LOC'  
 tal 'moon' tal-pitç<sup>h</sup> [talpit]<sup>9</sup> 'moonlight' tal-i [tari] 'NOM'

This *l* is changed into [r] without exception, even when *l* is followed by a glide-initial morpheme, supporting glides as a nucleus element. We can see this in (11).

- (11) il-jo-il 'Sunday' [irjoil] \*[iljoil]  
 kil-wəl 'writing' [kirwəl] \*[kilwəl]

The last supporting evidence for the NH is that, in Korean, no consonant cluster can occur in either the onset or the coda. As is seen in (12), some words have a consonant cluster in either the onset or the coda in their underlying representation. These words, however, do not retain two consonants at the surface level. No matter where the cluster is, one of the consonants has to be deleted. That is, the Korean syllable template has neither CCV(C) nor (C)VCC.

- |      |                                |                      |
|------|--------------------------------|----------------------|
| (12) | UNDERLYING FORM                | SURFACE FORM         |
|      | stək 'rice cake' <sup>10</sup> | [t'ək] <sup>11</sup> |
|      | skita 'be in between'          | [k'ita]              |
|      | nəks 'spirit'                  | [nək]                |
|      | talk 'hen'                     | [tak]                |

If we accept the glide as a member of the onset,<sup>12</sup> then we need the restricted condition: the consonant cluster is allowed only in the onset and the second member of the cluster has to be a glide. Assuming the NH, we do not need to admit consonant clusters in the syllable template of Korean.

## 2.2 Arguments for the Cluster Onset Hypothesis (COH)

Let us consider arguments for the Cluster Onset Hypothesis advanced by Lee 1993.

First, we can see why glide formation and glide insertion are triggered in Korean if we assume that a glide provides an onset. Glide formation (13) and insertion (14) are natural syllable repair mechanisms when a hiatus happens to occur. In the NH, it is difficult to explain why a glide is inserted between vowels.

### (13) Glide formation

- |                      |                       |                  |
|----------------------|-----------------------|------------------|
| tç <sup>h</sup> iu-ə | [tç <sup>h</sup> iwə] | 'to clean – IMP' |
| o-a                  | [wa]                  | 'to come – IMP'  |

## (14) Glide insertion

Minsu-a [minsuja] 'Oh, Minsu'  
 Minsu-Vocative

Second, the vowel harmony feature [RTR]<sup>13</sup> does not affect the glide. If the glides are in the nucleus, they should be the targets for the harmony. However, the glide is not affected, as we can see in (15).

- (15) wiŋ wiŋ → wɛŋ wɛŋ \*oɛŋ oɛŋ 'buzzing'  
 sjuŋ sjuŋ → sjoŋ sjoŋ \*seɔŋ seɔŋ 'whizzing'  
 k<sup>h</sup>wi khwi → k<sup>h</sup>wɛ k<sup>h</sup>wɛ \*k<sup>h</sup>oɛ k<sup>h</sup>oɛ 'foul smelling'

Third, the advocates of the COH doubt the reliability of the language-game data presented by Kim & Kim 1991 and Sohn 1987 under the NH. According to Lee 1993, Korean speakers produce *ja-pa ku-pu* as the only correct form for *jaku*. To them *ja-pja ku-pu* is not a possible form.

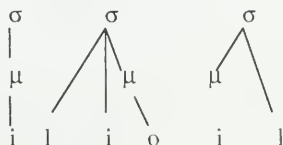
Fourth, contrary to the arguments of the NH, there exists a co-occurrence restriction between a consonant and a following glide: \**pw* and \**mw* are not good clusters, though *pu* and *mu* are possible. Similarly, \**sj* and \**tɕ<sup>h</sup>j* are not possible combinations, although *si* and *tɕ<sup>h</sup>i* are well-formed.<sup>14</sup> These show that glides are different from vowels in the nucleus.

The co-occurrence restriction holding between a glide and a vowel, such as \**ji*, \**ji*, \**wu*, and \**wo*,<sup>15</sup> can be explained by a universal tendency, such as avoidance of nonoptimal sounds.<sup>16</sup> Thus, this restriction cannot be used to support the NH.

Having observed that the COH is observationally more adequate than the NH, let us now turn to how the COH can handle the data presented as evidence for the NH.

First, as for Cluster Simplification seen in (3), Lee 1993 argues the COH can also handle (3). According to his explanation, Cluster Simplification simply does not apply when the glide is involved because the syllable template of Korean allows a consonant-glide cluster in the onset.<sup>17</sup>

Second, Lee's account of the *l/r* alternation in (10) and (11) is that both (10) and (11) obey the Maximal Syllable Onset Principle. The representation by Lee is in (16). Thus, the data are not incompatible with the COH. Under both the NH and the COH approaches, *l* is in the onset position, where it is pronounced as [r] because it meets the structural description of the *l* to [r] rule.

(16) a. COH approach<sup>18</sup>

## b. NH approach



Third, with regard to the reduplication in ideophones in (6), Lee claims that those are not a case of partial reduplication, but rather of total reduplication. After that, the words are subject to two other subsequent phonological rules independently required in Korean phonology. The first of these is the nasalization of liquids; liquids are changed into the homorganic nasal on the surface level when they occur in word initial position, as we can see in (17).

- (17)  $k^h w\epsilon-lak$  'pleasure'     $nak-w\epsilon n$  'paradise'  
        $kin-lo$  'work'         $no-tong$  'labor'

The second of these rules is the deletion of a nasal sound in word-initial position followed by a front vowel or front glide.<sup>19</sup> This is exemplified in (18).

- (18)  $su-nj\epsilon$  'nun'         $j\epsilon-t\zeta a$  'woman'  
        $sip-nj\epsilon n$  '10 years'     $j\epsilon n-mal$  'year end'

The derivation of *joung-rjoung* is given in (19).

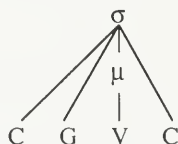
- (19)  $rj\epsilon ng$                     underlying form  
        $rj\epsilon ng-rj\epsilon ng$         full reduplication  
        $nj\epsilon ng-rj\epsilon ng$         nasalization  
        $j\epsilon ng-rj\epsilon ng$         nasal deletion

Giving this analysis, Lee 1993 points out that 'we do not have a single ideophone of this type, which has a consonant other than a liquid or an alveolar nasal. Given such restrictions, we may say that the deletion of liquids or an alveolar nasal may not be the result of the ideophone-specific onset deletion process.' We will see why this analysis presents difficulties in section 3.2.

### 3. Problems with the previous studies

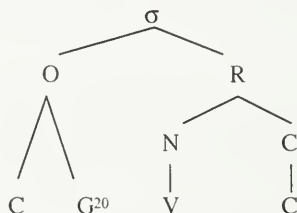
Both the NH and the COH make strong arguments as we observed above. However, both the NH and the COH encounter a theoretical problem. We need to consider the syllable structures suggested up to now for the Korean glides in order to grasp the theoretical consequences of these analyses.

(20) a.



Lee 1993

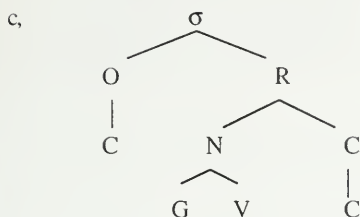
b.



Ahn 1986

Lee 1982





Kim-Renaud 1978

Sohn 1987

Kim &amp; Kim 1991

All the above structures reserve a separate position for a glide, no matter where it is located (i.e., in the onset or in the nucleus). The first two structures can be subsumed into one structure containing the branching onset. Roughly, we can classify the above structures into two kinds: one has a branching nucleus and the other has a branching onset.

### 3.1 Problems with the NH

The problems with the NH are clearly pointed out by Lee 1993. In this subsection, two theoretical problems and two more factual problems will be added to Lee's.

Let us consider first the theoretical problem. The NH postulates a branching nucleus with G and V. This has been called Short Rising Diphthong. But Short Rising Diphthong is very rare and is at best controversial. For example, Fu 1990, Harris 1983, and Kim & Kim 1991 argue for the diphthongal analysis of a pre-nucleus glide for Chinese, Spanish, and Korean respectively. However, these are challenged by Duamnu 1990, Carreira 1988, and Lee 1993, respectively. For French, Scullen 1993 proposes the onset analysis.

The second problem is that the structure with a branching nucleus breaks the one-to-one relationship between a segment and a constituent of a syllable, giving rise to a more complicated structure. Theoretically, all else being equal, there is no reason to accept the more complicated model.

In addition to the above-mentioned theoretical problem, the NH has some factual problems. First, contrary to what has been assumed in the NH, very strict co-occurrence restrictions hold between a consonant and a following glide. These restrictions are more restricted than those holding between a glide and the following vowel.<sup>21</sup>

The vowel inventory of Korean is [i, e, ɛ, ə, i, u, o, a].<sup>22</sup> (21) shows the possible glide-vowel combinations.

#### (21) Possible GV sequences in Korean<sup>23</sup>

- |   |               |
|---|---------------|
| a. je, jɛ, jə, ju, jo, ja <sup>24</sup> | *ji, *ji      |
| b. wi, we, wɛ, wə, wa <sup>25</sup>     | *wu, *wo, *wi |

As we saw in the previous section, these restrictions are explained by the more general avoidance of non-optimal sounds, and do not provide an argument in support of the NH. Now, let us see what restrictions hold for a consonant and a following glide, as shown in (22).

(22) Impossible CGV sequences<sup>26</sup> in Korean<sup>27</sup>\* t, t<sup>h</sup>, t', tɕ, tɕ<sup>h</sup>, tɕ', s' + jV<sup>28</sup>\* p p<sup>h</sup>, p', m + wV<sup>29</sup>,

The NH does not predict these co-occurrence restrictions between a consonant and a following glide.

The second phenomenon that the NH cannot explain is rhyming in Korean poetry. Under the NH, it is predicted that [<sub>rhyme</sub>GV(C)] in [(C)GV(C)] is a rhyme, but this prediction is not consistent with the facts. (23) shows a characteristic rhyming pattern of a famous modern poet named Yuk-Sa Lee analyzed by the Korean scholar Sang-Ho Lee 1984. The onset and the prenucleus G do not affect the rhyming pattern at all, that is, *nja* and *da* rhyme in (a), *lja* and *la* rhyme in (b), and *njo* and *ko* rhyme in (c).

## (23) Rhyming pattern (Sang-Ho Lee 1984)

- |                           |                              |
|---------------------------|------------------------------|
| a. <i>nja-o-ga-o-da</i>   | in Twilight <sup>30</sup>    |
| b. <i>lja-la-ta-la-la</i> | in Wild Land <sup>31</sup>   |
| c. <i>la-njo-la-la-ko</i> | in Spotted Cat <sup>32</sup> |

The rhyming patterns in (23) indicate that glides play no role in rhyming. This shows that the glide in Korean is not in the rime, but in the onset. Proponents of the NH might try to account for the rhyming within the NH. For example, according to Chao 1934, a syllable is comprised of an initial and a final. Then the final is composed of a glide and a rime, which in turn has a nucleus and a coda. The NH would require some such additional and unjustified stipulation, which is not needed in the OH.

### 3.2 Problems with COH

There are also facts that cannot be accounted for by the COH, which considers C and G as a consonant cluster. First, consider the branching onset structure, which is a tenet of the COH. In Korean, consonant clusters are not allowed in either the onset or the coda. Underlyingly, a very small number of consonant clusters occur in the coda, but these clusters are simplified before they appear at the phonetic level.<sup>33</sup> The only possible surface syllable structures for Korean are V, CV, VC, and CVC. If we consider a glide to be in the onset, taking a separate position, then we must explain why there is no other consonant cluster. Consider the generalization made by Duanmu 1990, given here in (24).

- (24) There is a cross-linguistic tendency that if a language allows an onset cluster C<sub>i</sub>C<sub>j</sub>, where the sonority distance between them is not the largest, then it should allow an onset cluster C<sub>i</sub>C<sub>k</sub>, where the sonority distance is larger (Greenberg 1964, Harris 1983, Selkirk 1984, Steriade 1982).

If we view a prenucleus glide and the preceding consonant as a consonant cluster, *lj* and *nj* are clusters. Duanmu's generalization predicts that Korean should, therefore, have other consonant clusters, with sonority distances larger than those of *lj* and *nj*, such as *\*pl* or *\*pr*. The sonority scales for the sounds relevant here is



that stops are 1, nasals are 2, liquids are 3, and glides are 4. However, there is no single consonant cluster in Korean except a cluster of a consonant and a glide. This is a serious problem for the COH. In section 5, we will examine this issue in more detail.

Second, the COH cannot explain the language-game data presented by the NH and illustrated in (8) and (9); additional examples are given in (25). Koreans make two forms in the language game, (25) and (26). The only data the COH can account for is (26). The COH cannot explain (25), because in (25) the inserted CV does contain a glide. If a glide is in the onset, it should be replaced by *p* along with the other consonant in the onset.

(25) LANGUAGE GAME I

- a. hakkjoe kajo 'go to school'
- ha-pak kjo-pjo e-pe ka-pa jo-pjo
- b. kwanjæk ij hwal 'arrow in the target'
- kwa-pwa njə-pjæk ij-pij hwa-pwal

(26) LANGUAGE GAME II

- a. hakkjoe kajo 'go to school'
- ha-pak kjo-po e-pe ka-pa jo-po
- b. kwanjæk ij hwal 'arrow in the target'
- kwa-pa njə-pæk ij-pij hwa-pal

Third, the COH does not account for the ideophone forms in (27), which contain consonants other than liquids and nasals. The only consonants expected to participate in the special partial reduplication are liquids and nasals under the COH.<sup>34</sup> The data in (27) should not exist according to the COH. The rules for the special partial reduplication apply only to nasals and liquids.

- (27) joli-tɕoli 'here and there' or 'this way and that way'
- jomo-tɕomo 'various sides'
- jomil-tɕomil 'meticulous'

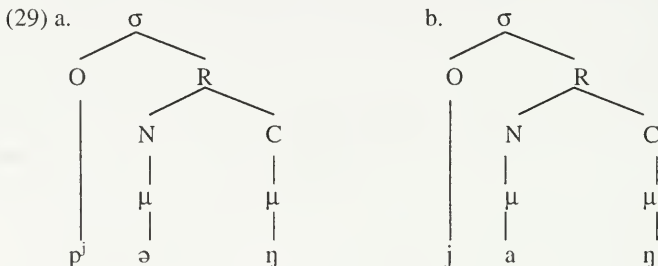
The evidence against the COH becomes even more compelling when considering the forms in (28), which contain *w* in the reduplicated part instead of *j*. The COH does not anticipate this occurrence, because the COH relies on the deletion of nasal sounds before a front vowel or a front glide to explain the partial reduplications in (7).<sup>35</sup>

- (28) weŋkilaŋ-teŋkilaŋ 'clinking'
- walkatak-talgatak 'rattling'
- waktal-paktal 'rudely'

(27) and (28) also challenge the NH. That is, *jam-njam* cannot be evidence for the NH, because we cannot be certain that the glide in *jam* comes from *njam*, since in (27) and (28), a glide appears in the reduplicated part even though the base words do not have glides.<sup>36</sup>

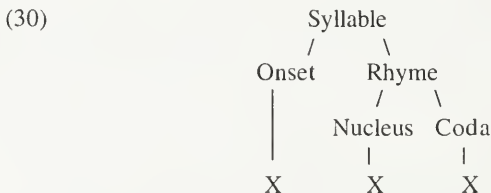
#### 4. The present analysis

My analysis agrees with the COH in that a glide is treated as a part of the onset. However, I also make three additional proposals. First, a glide in Korean is not a separate segment if another consonant precedes it. In such cases, the glide is a secondary articulation and does not form a consonant cluster. Thus, the representation of *p'əŋ* 'bottle' would be as in (29a). (29b) is the syllable structure of a word *jaŋ* 'a sheep' to show the structure when a glide is in the onset without another consonant.

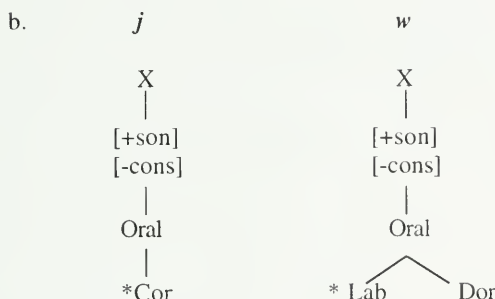
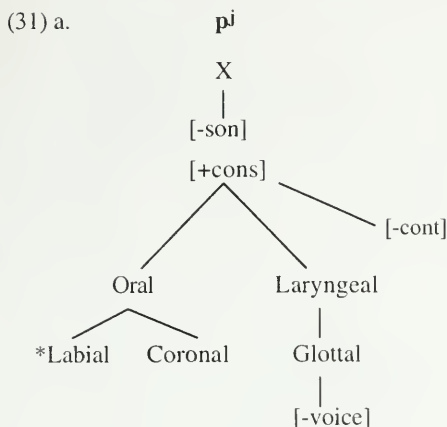


A consonant cluster  $C_j$  and a consonant with secondary articulation  $C^j$  are expected to have different timing structures. According to Ladefoged & Maddieson 1996, the total duration of a consonant with secondary articulation does not equal that of a sequence of two articulations in a cluster. Therefore, the claim that the Korean glide is a secondary articulation can be tested phonetically by measuring the time of  $C^G$  and  $CC$  and compare them. However, the comparison would not be easy, because Korean has no consonant clusters at all if we assume glides are a secondary articulation.

Second, along with the complex  $C^G$  with a secondary articulation, I adopt a simplified model for Korean syllable structure, which has only one position per syllable constituent as seen in (2), repeated in (30). Notice there is neither a branching onset, a branching nucleus, nor a branching coda. Every terminal node dominates one segment. That is, a syllable can have at most three slots.



Third,  $C^G$  is represented in a feature tree. As an illustration, the tree for  $p^j$  is given in (31a). To contrast the structures of plain glides,  $j$  and  $w$ , their structures are given in (31b).

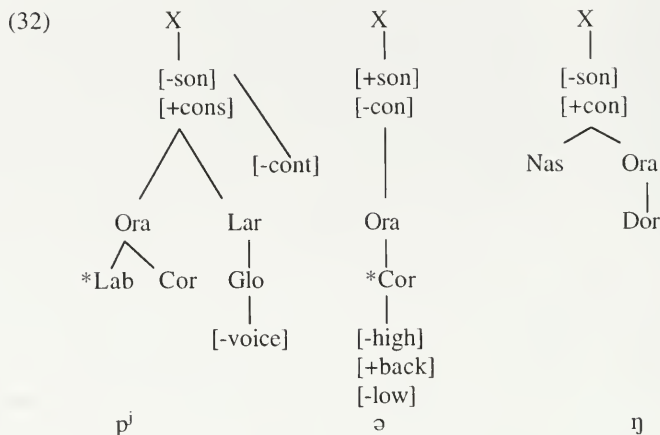


## 5. Illustration of the present analysis

In the following we will see how the present analysis works. How does this new proposal explain the phenomena involving Korean glides?

First, concerning phonotactic restrictions, we can predict which combinations are allowed to be considered one segment, and which ones are not. For example, as is exemplified in (32), *p* and *j* can form one segment because the former is articulated by the labial and the latter by the coronal articulator. In this paper I follow the assumptions of the current feature geometry that every articulator can occur once in a sound.<sup>37</sup>

However, if a consonant and a glide are both articulated by the labial, then it is difficult to express this combination within the current feature-geometry framework. In fact, it is precisely these CG sequences that are impossible in Korean, as shown in (33). The consonants that cannot precede *j* are all coronal obstruents, while those that cannot precede *w* are labials.

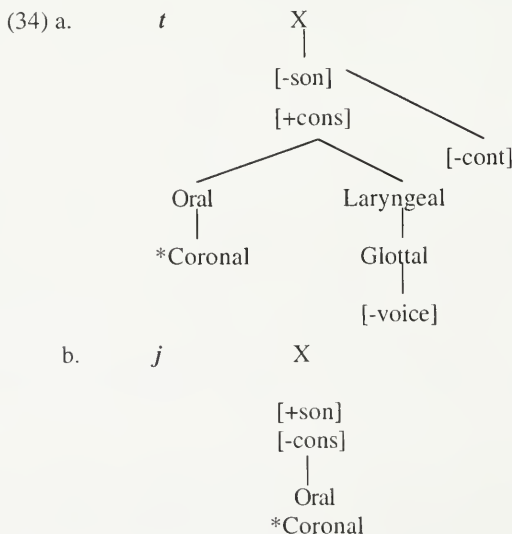


(33) Impossible CGV sequences in Korean<sup>38</sup>

a. \* *t*, *tʰ*, *tʰ*, *tɕ*, *tɕʰ*, *tɕʰ*, or *sʰ* + *j*V<sup>39</sup>

b. \* *p pʰ*, *pʰ* or *m* + *w*V<sup>40</sup>,

The feature-geometric representation of *t* and *j* are given in (34).

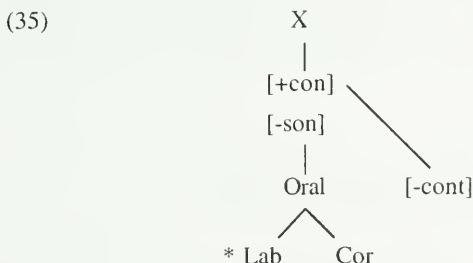


As these two sounds have Coronal as their articulator, they cannot be combined into one segment. The same is true of the other coronal consonants. In (33b), the consonant is a labial sound and the glide is also a labial. As expected, they cannot be a single segment. The analysis of this paper explains why there should be a

gap in the combination of a consonant and a glide in Korean, and also describes which combination is possible.

If advocates of the COH were to offer an explanation for the fact that some consonant clusters are allowed, but some are not, they would necessarily have to appeal to the sonority scale. But this approach inevitably encounters the problem. For example,  $p^j$  and  $l^j$  are possible consonant clusters, but  $p^l$  is not in Korean. Suppose the sonority of stops is 1, that of liquids is 2, and that of glides is 3. The sonority distances of  $pj$ ,  $pl$ , and  $lj$  are 2, 1, and 1 respectively. Then how can the COH explain why  $l^j$  is allowed, but  $p^l$  is not, in terms of sonority? This sonority argument is very weak.

Under the SOH, the nonoccurrence of  $p^l$ ,  $p^r$ ,  $m^l$ ,  $p^n$ , and the other combinations of consonants is easily explained. According to Sagey 1986, as cited by Duanmu 1990, the structure in (35) is interpreted by default as  $[p^j]$ , rather than  $[p^l]$ , because the universal default values for a secondary articulation are  $[-\text{cons}]$  and  $[\text{+son}]$ . We also assume a bare secondary articulator, which does not dominate any offspring node.



Second, nothing special needs to be said about the Consonant Cluster Reduction, which was presented in (4) and is repeated in (36).

- (36) ol-pjə      'this year's crop'  
       sil-kwa      'fruit'

Even though we consider the glide as being in the onset,  $p^j$  or  $k^w$  is just one segment. Thus, it is natural for the words in (36) not to be subject to the reduction rule. This was a little problematic for the COH because it posits two segment positions in the onset.

Third, the SOH can also account for the entire range of the data from the language game. For the speakers who discard a glide in the inserted CV, the rule governing the game is a deletion of the whole onset. For the speakers who keep a glide in the inserted CV, the governing rule is a deletion of only the primary articulator from the onset segment.<sup>41</sup>

Fourth, when we use the feature tree, we do not need to refer to the higher node, such as the nucleus, for vowel harmony. Referring to a higher node is inevitable in the COH. The explanation provided by Lee 1993 is the following: Korean vowel harmony involves spreading of the feature  $[RTR]$  to the nucleus segment. The reason harmony process skips the glide is that a glide is in the onset, not in

the nucleus. Under feature geometry, the representations of every vowel should have the Dorsal articulator as its major articulator while a glide has Cor or Lab as its primary articulator. The [RTR] feature just spreads to the primary \*Dor and a glide is ignored by this spreading.

Fifth, consider the partially reduplicated ideophones of (27) and (28), repeated in (37) and (38). The previous analyses from the COH or the NH did not handle these data, as I pointed out above.

- |      |                   |   |
|------|-------------------|---|
| (37) | joli-t̚oli        | 'here and there' or 'this way and that way' |
|      | jomo-t̚omo        | 'various sides'                             |
|      | jomil-t̚omil      | 'meticulous'                                |
| (38) | wɛŋkilaŋ-tɛŋkilaŋ | 'clinking'                                  |
|      | walkatak-talgatak | 'rattling'                                  |
|      | waktal-paktal     | 'rudely'                                    |

My explanation for these data is as follows. First, delete the onset. Second, insert a minimal [+cons] element to satisfy the Onset principle, which is *w* before [-round] vowel and *j* before [+round] vowel.<sup>42</sup> In *jam-njam*, even though the vowel is [-round], *j* appears. This might appear to be an exception, but it is not: *w* is replaced by *j* because \**wam* is not a permitted sequence in Korean.<sup>43</sup> The derivation is given in (39).

- |      |                       |                                     |
|------|-----------------------|-------------------------------------|
| (39) | n <sup>h</sup> am     | base                                |
|      | am-n <sup>h</sup> am  | partial reduplication for ideophone |
|      | wam-n <sup>h</sup> am | insertion of [+cons] element        |
|      | jam-n <sup>h</sup> am | dissimilation                       |

Sixth, regarding the *l/r* alternation (recall (10) and (11)), the SOH gives a simple explanation. Under the SOH, the segment is represented in the feature tree. The features of *l<sup>w</sup>* are not in strictly linear order. That is, *l<sup>w</sup>* is not a combination of *l* and *w* in order. This is followed from one of the basic assumptions of non-linear phonology, to which feature geometry belongs. The relevant assumption here is that a phonological representation is not linear but multi-dimensional, placing different gestures at different tiers. Thus *l* can see the following vowel in spite of Lab of *w*. *l* in (40) meets the structural description of the *l* to [r] rule. As a result, it is changed into [r].

- |      |     |      |                |      |      |           |
|------|-----|------|----------------|------|------|-----------|
| (40) | k   | i    | l <sup>w</sup> | ə    | l    | 'writing' |
|      | X   | X    | X              | X    | X    |           |
|      |     |      |                |      |      |           |
|      | Dor | *Dor | *Cor           | *Dor | *Cor |           |
|      |     |      | Lab            |      |      |           |

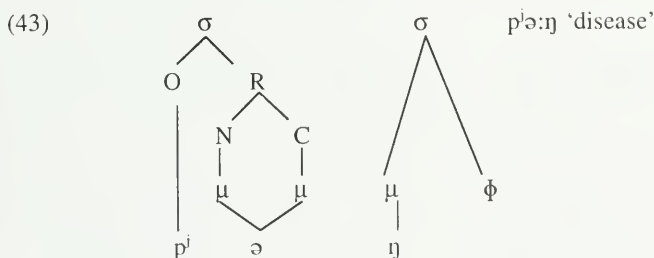
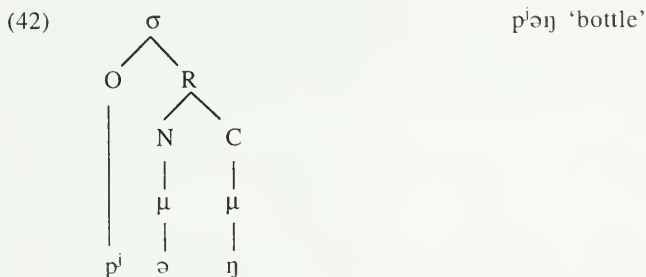
Seventh, in respect to the glide formation and insertion in (13) and (14), the explanation of the SOH is almost the same as that offered by the COH. A glide is a part of the onset when it is preceded by another consonant, while it itself is an onset when it is the only member of the onset. Thus, it is an expected phenomenon that a glide is inserted or formed to resolve the hiatus when two vowels happen to occur side by side.



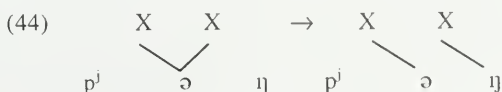
I turn now to potential problems of the SOH. First, for the speakers of the Chonnam dialect, the length of the vowel is phonemic, as shown by the Chonnam minimal pairs in (41). Recall that the syllable structure I propose has only three positions in it. The words such as  $p^j\text{ə}:\eta$ ,  $m^j\text{ə}:\eta$ , and  $j\text{ə}:\eta\text{ki}$  seem to need four positions within a syllable (two for vowel length).

- |      |                           |                |                          |                  |
|------|---------------------------|----------------|--------------------------|------------------|
| (41) | $p^j\text{ə}:\eta$        | 'disease'      | $p^j\text{ə}\eta$        | 'bottle'         |
|      | $m^j\text{ə}:\eta$        | 'face, aspect' | $m^j\text{ə}\eta$        | 'cotton, noodle' |
|      | $j\text{ə}:\eta\text{ki}$ | 'performance'  | $j\text{ə}\eta\text{ki}$ | 'smoke'          |

A possible solution to the Chonnam dialect case is illustrated by the representations in (42) and (43). As we do not allow two places under one constituent of a syllable, the coda of  $p^j\text{ə}:\eta$  has no place to be linked to in the first syllable. Therefore, it forms an independent syllable with zero rhyme in (43). The analysis I follow in this paper is different from the traditional view of syllable structure; for arguments in favor of the new analysis, see Harris (1994:83) and Burzio (1994:55-65).



The prediction from the above representation is that the stranded consonant can be resyllabified with the following vowel when this word is suffixed by a vowel-initial morpheme. However, when this is followed by a consonant-initial morpheme, the stranded element cannot find a place in the second syllable to be linked to, thus,  $\eta$  must be syllabified with the first syllable. In this case, the first syllable cannot hold a long vowel, as is seen in (44).<sup>44</sup>



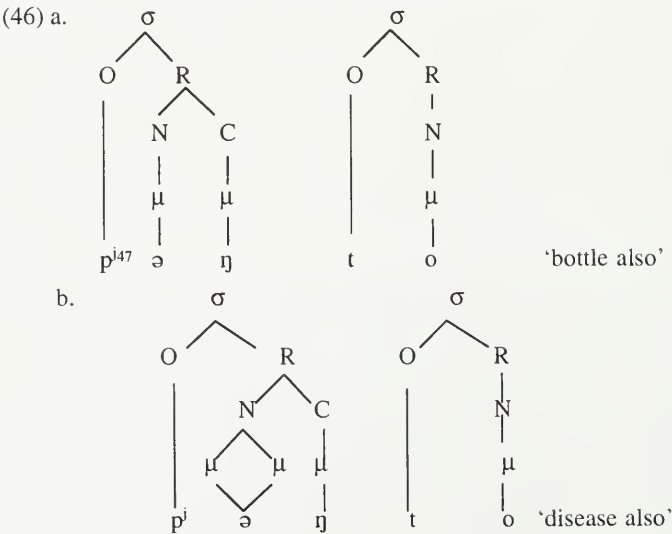
The result would be that the length difference between the minimal pairs would disappear. This prediction proves to be true, based on a preliminary analysis of a small set of minimal pairs.<sup>45</sup> The table in (45) gives the duration of four word pairs differing only in length.<sup>46</sup> Each pair was produced twice by a native speaker of the Chonnam dialect.

(45) Phonetic measurement of duration of words in CGV(:)C + CV(CV)

WORD + SUFFIX	REPETITION 1	REPETITION 2	AVERAGE
pjə:ŋ + to 'disease also'	360ms	300ms	330ms
pjəŋ + to 'bottle also'	300ms	280ms	290ms
pjə:ŋ + k'atçi 'disease even'	500ms	400ms	450ms
pjəŋ + k'atçi 'bottle to'	480ms	480ms	480ms
mjə:n + to 'side also'	540ms	700ms	620ms
mjən + to 'noodle also'	500ms	740ms	620ms
mjə:n + k'a tçi 'side also'	500ms	460ms	480ms
mjən + k'a tçi 'cotton also'	500ms	460ms	480ms

As predicted, we cannot find any systematic difference in duration between the words with a short vowel and those with a long vowel.

The branching model cannot accommodate this result. The representations assumed under the branching nucleus would be as in (46).



According to the structures in (48), the length difference should be maintained after suffixation because the nucleus node can be branched and thus can house the long vowel, regardless of whether the following suffix begins with a vowel or a consonant. Thus, the duration measure, although based on a relatively few tokens from a single speaker, provides the positive evidence for the argument that only one segment can come before and after the syllable peak (= vowel).

Second, one might ask whether this analysis would posit additional consonants in the phonemic inventory of Korean. If it did, there would be no substantial gain in adopting a simpler syllable structure because, as a trade off, a simpler structure would inevitably increase the number of phonemes. However, this is not the case. We postulate the same number of phonemes, i.e., C's, w, and j. C<sup>w</sup> and C<sup>j</sup> are not distinct phonemes. In the phonemic inventory there are only simple consonants and glides independently. The features, which compose these independent phonemes, are combined to make a complex segment when a consonant is followed by a glide, because in the present analysis we permit only one position for an onset. As Duanmu (p.c.) points out, there may be an intermediate level, between the phonemic and phonetic levels, the so-called syllabic level. In that level a glide and the preceding consonant are merged. This merged sound is realized as one sound at the phonetic level. This process is illustrated in (47).

(47) Phonemic level :	C,	G,	V	
Syllabic level :	O	N		(C)
	∧			
	C	G	V	(C)
Phonetic level :	C <sup>G</sup>	V	C	

Take *kway* 'barn' as an example. At the phonological level, we have *k*, *w*, *a*, and *ŋ*. At the syllable level, the most sonorous element, *a*, takes the nucleus position. It is important to remember that we have only three slots in the syllable. *k* and *ŋ* take the onset and the coda position, respectively. The problem is to assign a slot to a glide, *w*, which cannot be linked to the nucleus because these two sounds have contradictory and incompatible features: *a* is [+low] and [-high] but *w* is [-low] and [+high]. The only possible position for *w* is the onset<sup>48</sup>. *w* can be connected to *k* because the combination of these two sounds do not disobey any feature-geometric principles: *w* has a Labial articulation and *k* has a Dorsal articulation. The less sonorous element, *k*, is the main part of the onset and the more sonorous is added as a secondary articulation to it.

## 6. Implications

The above analysis assumes a simpler syllable structure for Korean than do the NH and the COH. The simple structure is preferred as long as it has at least the same power of explanation as the more complicated structure. As has been argued here, the simple structure provides an even more efficient way to account for phenomena involving glides in Korean.

The simple syllable structure with one position per constituent of a syllable accounts for the new facts as well as the previously known facts. This is summarized in (48).

(48) Comparison of explanatory power

	NH	COH	SOH
Co-occurrence	No	Yes (in part)	Yes (explains why)
Consonant cluster reduction	Yes	Yes (as exception)	Yes (naturally)
Ideophones with <i>j</i> and liquids	Yes	Yes	Yes
Ideophones with <i>w</i> and other Cs	Yes	No	Yes
Language Game	Yes (for half the data)	Yes (for half the data)	Yes (for all the data)
L/r alternation	Yes	Yes	Yes
No cons. cluster	Yes	No	Yes
Vowel harmony	No	Yes	Yes (more naturally)
Glide formation	No	Yes	Yes
Length neutralization	No	Yes	Yes

This paper has shown that a simpler syllable structure can explain a new set of the Korean data not dealt with previously and provides a better explanation for the facts already studied than do the NH and the COH.

### NOTES

<sup>1</sup> This is the view suggested by Paul Newman at the 3<sup>rd</sup> Mid-Continental Workshop on Phonology, Indiana University, 1997.

<sup>2</sup> Steriade (1988:121) points out that 'co-occurrence constraints based on sonority distance are found exclusively within the pre- or post-nuclear section and never between the nucleus and the pre-nucleus section.'

<sup>3</sup> This excludes the idea that a glide selects the element on its right side rather than on its left side in the flat structure.

<sup>4</sup> *tʃ* is an affricate rather than two consonants, usually transcribed as *c*. In this paper, the IPA symbol is used.

<sup>5</sup> Lee 1993 analyzes the reduplication data based on the assumption that the second part of the ideophones is the base for the reduplication. For more detail, see Lee 1993.

<sup>6</sup> I use the diacritic ' to indicate tenseness rather than an ejective.

<sup>7</sup> Some native speakers of Korean disagree with the base form of these words. They think these words are formed through full reduplication of the base form with no onset consonant. For them, the word for 'tasty' is *jam-jam*, not *jam-njam*.

<sup>8</sup> According to Lee 1993, (9) is not a correct form. I will return to this point.

<sup>9</sup> In Korean only 7 consonants, [p], [t], [k], [m], [n], [l], and [ŋ], can occur in the coda position, where every fricative is realized as a stop and every obstruent loses its fortis or aspirated character.

<sup>10</sup> The consonant cluster in the onset does not exist any longer in Modern Korean.

<sup>11</sup> The change from *st* to [t'] is due to Tensification.

<sup>12</sup> Here the COH assumes an onset consonant and a glide are in the onset as a consonant cluster, not as one complex segment.

<sup>13</sup> [RTR] is dominated by the Radical articulator under the Pharyngeal cavity according to Halle 1992.

<sup>14</sup> Lee 1993 contends that *sj* is not possible, but I do not agree. For details, see (22).

<sup>15</sup> Lee 1993 postulates the phonotactic constraints such as \*[+high, -round] [+high, -round] for *\*ji* and *\*ji* and \*[+round][+round] for *\*wu* and *\*wo*. The second constraint does not work due to *\*wi*.

<sup>16</sup> Lee 1993 cites Ohala & Kawasaki 1984, who claim that combinations of similar sounds do not make a sufficient distinction. Thus, the combinations are rare. This also accounts for the nonoccurrence of *uu* and *ii* in Korean.

<sup>17</sup> In *kaps-to*, *st* is not permissible in the Korean syllable template. Thus, this consonant cluster must be simplified.

<sup>18</sup> Lee 1993 does not assign any mora for the coda consonant.

<sup>19</sup> By a nasal sound, Lee 1993 seems to mean an alveolar nasal sound, because Korean has a labial nasal in word-initial position followed by a front glide or front vowel as in the name *Mirjŏng*.

<sup>20</sup> Ahn 1986 and Lee 1982 assume two segments in the onset.

<sup>21</sup> As mentioned in §2.2, some of these restrictions are pointed out by Lee 1993.

<sup>22</sup> Some Korean phonologists claim there is one more vowel,  $\emptyset$ . However, this sound is now not distinctive from *we* and *wɛ* and is no longer a monophthong in the Seoul dialect.

<sup>23</sup> Compare this with Lee's observation in § 2.2.

<sup>24</sup> *je* and *jɛ* do not occur after a consonant in the onset.

<sup>25</sup> *we* and *wɛ* do not occur after a consonant in the onset.

<sup>26</sup> Compare this with Lee's observation in 2.2.

<sup>27</sup> Here I refer to the phonological level. Orthographically *tɕjV*, *tɕʰjV*, *tɕ'jV*, and *s'jV* are possible but not at the phonological level. For example, the first letter of the Korean version of the English loanword *chocolate* is *tɕʰjo* orthographically, but is pronounced /tɕʰo/.

<sup>28</sup> Exceptionally, *s* can precede *jV*. I found that the pronunciation of *s* + *jV* is exactly the same as a palatal sound [ɕʰ] + *V*. This sheds some light on the apparent exception, implying that *s* and *j* form one palatal sound. For more details, see Duanmu [forthcoming]. *s'jo* is possible exceptionally only for the English loanword *show*.

<sup>29</sup> *mwə* 'what', *pwə* 'pour + IMP', and *pwa* 'see + IMP' are permitted in the orthography. It is noteworthy that these combinations are all a result of glide formation from the underlying forms of *mu* + *ə*, *pu* + *ə*, and *po* + *a*, respectively. According to the author's native-speaker intuition, these combinations are pronounced without a glide at the phonetic level, turning them into *mə*-, *pə*, and *pa*.

<sup>30</sup> The name of a poem.

<sup>31</sup> The name of a poem.

<sup>32</sup> The name of a poem.

<sup>33</sup> When this consonant cluster is followed by a vowel-initial morpheme, then one of the consonants is resyllabified as the onset of the following syllable. When the consonant cluster is followed by a consonant-initial morpheme, then one of the consonants is deleted. As a result, there appears to be no syllable with a consonant cluster at the surface level.

<sup>34</sup> See § 2.2.

<sup>35</sup> See (19).

<sup>36</sup> The NH uses *jam-njam* to argue that the reason [j] remains in the reduplicated part is that [j] is not in the onset.

<sup>37</sup> Beddor (p.c.) points out that there are languages which allow lip-rounding gesture as a secondary articulation even when the primary articulation is made at the lip. For examples of these languages, see Ladefoged & Maddieson 1996. Current feature-geometry theory does not provide a plausible explanation for the existence of these sounds, which involve the same articulator both for a primary articulation and for a secondary articulation. However, as we can see in Ladefoged



& Maddieson's report that labialization as a secondary articulation is especially common with velar or uvular consonants and that many languages permit labialization only of back consonants, languages prefer the sounds produced by a different articulator for a secondary articulation from a primary articulation. For example, labialization with other consonants than labial consonants is preferred. At least for the languages that show this preference, the current feature-geometry theory provides a good explanation.

<sup>38</sup> See fn. 27.

<sup>39</sup> See fn. 28.

<sup>40</sup> See fn. 29.

<sup>41</sup> What happens to the onset when it consists of a glide, not a complex segment with a glide in it? The ending suffix *-jo* gets the form *jo-pjo* or *jo-po* in the language game. *Yo-po* is produced by deleting the whole onset segment. For *jo-pjo*, Duanmu (p.c.) informs me that there is a proposal, which needs so-called feature recycling. When a segment is deleted, some features of the segment that are compatible with the features in the following segment survive in the following segment. For example, when [kj] is deleted before [p], features of [j] move into [p] because the resulting sound [p<sup>j</sup>] is a possible sound. However, the feature of [k] cannot survive on [p] because [p<sup>k</sup>] is not a possible segment.

Turning to the language game again, when the onset is deleted, the coronal feature survives on the new onset consonant. This is possible because [pj] is an admitted segment in Korean. That is, we can say that in one version of the language game, (25), features are recycled. Or we can say that in both versions of language games, (25) and (26), features are recycled, but in (26), a secondary articulator is not allowed in the output.

<sup>42</sup> This is due to a kind of dissimilation.

<sup>43</sup> This is due to a kind of dissimilation. Neither the sequence of wVp nor wVm is permitted in Korean. Although *k<sup>w</sup>am* is permitted, we may accommodate this exception by suggesting that only the features of primary articulators are subject to dissimilation. I am indebted to C-W. Kim for this observation.

<sup>44</sup> In my analysis, vowel shortening follows from syllable structure. Consider *pjə:.ŋ*, *pjə:.ŋi*, and *pjəŋ.to*. Vowel shortening occurs only in the third case because the coda consonant cannot find room in the following syllable. If the vowel shortening were due to a loss of the vowel length distinction in modern Korean, it would be difficult to see how vowel shortening is accounted for in a simple manner without referring to syllable structure. For example, *pjə: . ŋi*, and *pjəŋ . to* have two syllables, but vowel shortening occurs only in the second case.

<sup>45</sup> The experiment is indeed a very small-scale pilot study, and a large-scale investigation would be helpful.

<sup>46</sup> Measurements were taken of the whole word not just of the first syllable or the vowel.

<sup>47</sup> Whether it is *p'* or *pj* and whether it is in the onset or in the nucleus, the issue is not relevant here, because usually the element in the onset is not considered to be a mora, and a glide bears no mora according to the NH, either. Therefore, with regard to the length difference, it does not matter whether the onset has one segment or two, or a glide is in the onset or in the nucleus.

<sup>48</sup> *wa* is bad only when we analyze it as one sound in the nucleus, because *w* and *a* have contradictory features. Thus, the presence of *aj*, *aw*, and other falling diphthongs is not a problem. According to the standard analysis, *aj*, *aw*, etc., are not one sound, but two, and are equal to a long vowel. Each of their components has a separate set of features, and in each feature set, there is no conflict of features.

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